

**Statement of**  
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**National Aeronautics and Space Administration**  
**before the**  
**Subcommittee on Science, Technology and Space**  
**United States Senate**  
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Mr. Chairman and Members of the Subcommittee, thank you for this opportunity to appear today to discuss the Space Shuttle and future launch vehicles. When the President visited NASA Headquarters on January 14 and announced the Vision for Space Exploration, he presented a vision that is bold and forward thinking, yet affordable and achievable. He stated that the first order of business was to safely return the Space Shuttle to flight as soon as practicable, complete assembly of the International Space Station (ISS), and fulfill the commitments to our International Partners. Once the ISS assembly is complete, planned for the end of the decade, the Space Shuttle -- after nearly 30 years of duty -- will be retired from service. These are the first steps on the journey to fulfill the Vision for Space Exploration.

After the Challenger accident, NASA has relied on a Mixed Fleet Launch Strategy to meet the launch requirements of NASA's diverse program objectives. This Mixed Fleet Launch Strategy takes advantage of both domestic and partner launch capability and enables focused use of the unique Space Shuttle capabilities. Our approach enables us to continue to support the ISS through reliance on partner assets, while NASA addresses the Columbia Accident Investigation Board (CAIB) recommendations and focuses on returning the Shuttle safely back to flight. Since the Columbia accident, NASA has continued flying important science missions, including deployment of the Space Infrared Telescope Facility, now called the Spitzer Telescope, and the back-to-back Mars missions last summer on domestic commercial launch systems. NASA expects to continue this Mixed Fleet Strategy as we embrace the new challenges of the Vision for Space Exploration.

**Space Shuttle Return to Flight**

As the loss of Columbia and her crew has reminded us, working in space is inherently risky. The CAIB recognized the risks associated with operating the Space Shuttle and made its recommendations consistent with the overriding objective of safety. NASA recognizes these risks and is working to mitigate them, while moving forward to accomplish our missions.

On April 26, 2004, NASA provided to Congress the latest version of *NASA's Implementation Plan for Space Shuttle Return to Flight and Beyond*. This plan details the currently anticipated work schedule and cost estimates for Return to Flight (RTF) activities so that we can safely return

the Space Shuttle to flight. In addition to providing updates on NASA's progress towards RTF, the implementation plan recognizes the long-term goals of human planetary exploration outlined in the Vision for Space Exploration.

The planning window for the next launch of the Space Shuttle is currently scheduled for March 6, 2005 – April 18, 2005. Prior to launch, NASA must successfully address all fifteen RTF recommendations from the CAIB. The RTF Task Group, chaired by Richard Covey and Thomas Stafford, is charged with assessing the implementation of these recommendations. The Task Group, as of April 15, 2004, agreed to close three RTF recommendations. The three recommendations that have been closed are:

- Recommendation 3.3-1 – Develop and implement a comprehensive inspection plan to determine the structural integrity of all Reinforced Carbon-Carbon system components. This inspection plan should take advantage of advanced non-destructive inspection technology.
- Recommendation 4.2-3 – Require that at least two employees attend all final closeouts and intertank area hand-spraying procedures.
- Recommendation 6.3-2 – Modify the Memorandum of Agreement with the National Imagery and Mapping Agency to make the imaging of each Shuttle flight a standard requirement.

NASA is committed to addressing all CAIB recommendations, as well as self-initiated “raising the bar” actions. The updated implementation plan shows that NASA continues to make progress in all efforts to make the Shuttle safer. The revised schedule for implementing the CAIB recommendations shows that NASA has a deliberate approach for achieving all necessary milestones required to close each action item.

When we return to flight, the Space Shuttle will be the safest it has ever been. NASA has confidence in its ability to maintain that level of safety throughout the life of the Space Shuttle program. NASA is also confident that the Space Shuttle program can accomplish its role in the Vision for Space Exploration to complete International Space Station assembly.

The focus of the Space Shuttle will be finishing assembly of the International Space Station (ISS). With its job done, the Space Shuttle will be phased out when assembly of the ISS is complete, planned for the end of the decade. NASA will determine, over the next year, how best to optimize the use of the Space Shuttle fleet for the remainder of its service life, and what investments are required to ensure its safety, reliability and maintainability during this period.

### **International Space Station**

NASA plans to complete assembly of the International Space Station (ISS) by the end of the decade, including those U.S. components that will ensure our capability to conduct research in support of the new Vision for Space Exploration goals and those components planned and provided by our International Partners. The unique capabilities of the Space Shuttle are essential to the successful completion of the ISS. The ISS and its elements, most of which are already built, have been designed to take advantage of the more benign Shuttle flight environment in the Shuttle's cargo bay, removed and repositioned by the Shuttle's robotic arm, and connected together by the Shuttle's astronaut crews during space walk activities.

The International Space Station (ISS) research plans, assembly sequence, and final configuration are being re-examined as part of the Agency refocus to meet the Vision for Space Exploration. How we support the ISS through its assembly and operational phases is also under re-examination. NASA will continue its Mixed Fleet Launch Strategy and optimize existing partner assets as we assess opportunities using domestic capabilities to support the ISS. NASA is targeting completion of the re-evaluation of assembly, utilization, logistics, and maintenance requirements of the ISS for later this summer. The ISS program is currently working closely with our International Partners to develop a plan for meeting the revised requirements. We expect a refinement of our Mixed Fleet Launch Strategy including Space Shuttle launch requirements needed to complete assembly of the ISS to be an outcome of this process.

The ISS Mixed Fleet Strategy concept of operations for the ISS has, to date, included the Space Shuttle and Russian provided Soyuz and Progress vehicles. In the future, it will also include the European Automated Transfer Vehicle, and the Japanese H-II Transfer Vehicle, which are both currently under development. NASA is also evaluating opportunities for augmenting the Mixed Fleet with additional domestic launch systems. To this end, the President's FY 2005 Budget Request includes funding for initiation of an ISS crew and cargo capability. NASA plans to release a request for proposals in mid-2005 to acquire capability for meeting ISS operations requirements as soon as practical and affordable.

The ISS offers us a tremendous opportunity to study human survival in the hostile environment of space and assess how to overcome the technology hurdles to human exploration beyond Earth orbit. NASA research activities aboard the ISS will be focused to support the new exploration goals, with an emphasis on understanding how the space environment affects astronaut health and capabilities, and on developing appropriate countermeasures to mitigate health concerns. ISS will also be vital to developing and demonstrating improved life support systems and medical care. Over the next year, the Biological and Physical Research Enterprise will conduct a thorough review of all research activities to ensure that they are fully aligned with and supportive of the new Vision for Space Exploration.

The ISS is preparing us for future human exploration in many ways. It is an exploration research and technology test bed. It is a platform that represents an unprecedented accomplishment for space engineering and on-orbit assembly of unique and complex spacecraft. It is a model for future space operations, linking mission control centers on three continents to sustain space flight on-orbit operations -- twenty-four hours a day, seven days a week -- by an international team composed of representatives from the U.S., Russia, Europe, Japan and Canada. Perhaps the most significant contribution of the ISS Program is that it is a foundation for international partnerships and alliances between governments, industry, and academia in space exploration. The success of the ISS assembly to date and its continued successful operation during the absence of the Space Shuttle launches is a tribute to the engineering excellence and successful cooperation of the international team.

The capability of this model is further evidenced by the successful launch of a new crew to the ISS and the return to Earth of the previous crew last week. The Expedition 9 crew, NASA ISS Science Officer Mike Fincke and Russian cosmonaut Commander Gennady Padalka, were launched to the ISS from Baikonur Cosmodrome in Kazakhstan on April 18, 2004 EDT on ISS Flight 8S (Soyuz TMA-4). Fincke and Padalka, along with European Space Agency astronaut Andre Kuipers of The Netherlands, docked to the ISS on April 21, 2004 EDT.

After a week and a half of successful experimentation and handover activities, Kuipers then joined the Expedition 8 crew, Commander and NASA ISS Science Officer Mike Foale and

Russian cosmonaut Flight Engineer Alexander Kaleri on ISS Flight 7S (Soyuz TMA-3) for their return to Earth April 29, 2004, 8:11 pm EDT.

Mission Control Center (MCC)-Houston and MCC-Moscow continue to work closely and efficiently to resolve anomalies, perform avoidance maneuvers, monitor Soyuz and Progress dockings, and re-boost and reorient the ISS as required. There are on-going ISS technical challenges, but the corrective maintenance is performing better than anticipated. Anomalies are being addressed, and overall the system is consistently stable. The operations teams have successfully resolved system anomalies, but continue to watch crew health maintenance systems, Russian life-support systems, attitude control, and various components of cabin pressure. All of these on-orbit scenarios and changing situations from which we are prepared to safely deal with and learn from, will better enable NASA to fulfill the Vision for Space Exploration.

### **International Space Station Assembly Transportation Alternatives**

To meet the goals laid out in the Vision for Space Exploration, NASA is evaluating the current manifest for flights to the ISS. To complete ISS assembly by the end of the decade, NASA is reviewing the assembly sequence and final ISS configuration, as well as the complement of currently available and proposed domestic and international vehicles that are capable of delivering crew and cargo to and from the ISS, and the predicted Shuttle return to flight date. This evaluation, which will factor in the historic turn around time between Shuttle flights, is expected to be complete in the summer and will provide a better idea of how many Shuttle flights will be needed to complete assembly of the ISS. NASA will trade ISS requirements against launch capabilities to ensure that the Shuttle can be operated safely and the ISS assembly can be completed by the end of the decade, consistent with the Vision for Space Exploration.

Conducting ISS assembly mission using vehicles other than the Shuttle would be very difficult. Prior to and since the Columbia accident, NASA has assessed alternative launch capabilities to support ISS assembly in addition to crew and cargo re-supply studies. The difficulty in replacing the Shuttle in ISS assembly is that ISS elements and partner facilities have been designed to take advantage of the Space Shuttle's unique volume and performance, and more benign launch environment. None of the domestic or partner launch systems have the capability to meet requirements for assembly of remaining ISS elements without significant modification of either the vehicle or the ISS elements.

For example, NASA could invest in upgrades to the heaviest planned versions of domestic Expendable Launch Vehicles (ELV's) to address current mass and volume shortfalls. There remain, however, significant challenges that drive risk, schedule, and cost to accommodate the transition in operations concept for ISS assembly items that are already built and designed specifically for the Shuttle capabilities and launch environment. The most driving challenge is how to define a new operations concept and assembly process that uses ISS crew without the benefit of the Shuttle's remote manipulator arm or space walking crewmembers to safely complete each assembly mission. Investment would also be required to develop a domestic transfer vehicle capability and define new operations concepts to enable ELV deployment and element rendezvous and docking with ISS. The existing ISS structures and facilities would need to be redesigned to meet the new ELV flight environment and would also need to develop an ELV carrier to replicate Shuttle attach points. Due to multiple parallel development and test schedules that would be required, NASA estimates that canceling the Shuttle now and using only

ELV's to build the ISS would result in a minimum four to five year delay in restarting ISS assembly.

The significant challenges and risks associated with replicating the Shuttle's capability for the remaining assembly flights have led NASA to focus on use of the Shuttle for assembly of the ISS, while continuing to pursue alternatives to the Space Shuttle for non-assembly tasks and post-Shuttle ISS support.

### **Partnerships**

The Office of Space Flight is working closely with the Office of Exploration Systems and the Department of Defense to understand evolving launch requirements to ensure an integrated National launch strategy within the stagnant launch market. NASA, the United States Air Force, and the National Reconnaissance Office held the fourth Government and Industry ELV Mission Assurance Forum on March 9-10, 2004. At this year's forum NASA shared lessons learned from the CAIB review of the Space Shuttle program as we are applying them to our launch services program.

This forum was originally established by our agencies to ensure that the lessons learned from the 1998 Presidential Broad Area Review into ELV launch failures are not forgotten. The Broad Area Review identified the importance of government users to serve as knowledgeable buyers of launch capability and the benefit of value added government technical oversight to enhance mission success. A critical lesson not to be relearned is the importance of added government diligence in the area of systems engineering when programs and their contractors are in periods of transition and/or under severe cost pressures. This is exactly the environment the Nation faced in 1998.

To formalize our cooperative efforts, NASA and members of the Defense community established the Partnership Council in 1997 to provide an opportunity for the senior space principals to meet face-to-face on a regular basis to discuss issues relevant to the space community. The purpose of the Partnership Council is to facilitate communication between the organizations and to identify areas for collaboration and cooperation. Much of the benefit of the Partnership Council is the day-to-day activities and relationships built within the government community engaged in space.

### **Summary**

NASA's Mixed Fleet Launch Strategy is being updated to address the Vision for Space Exploration. NASA is developing a strategy to acquire ISS crew transport, as required, and cargo transportation as soon as practical and affordable. NASA envisions that commercial and/or foreign capabilities will be the building blocks for our future Mixed Fleet Launch Strategy, as it has served us well. NASA remains confident that the Space Shuttle can be operated safely for the remainder of its service life and the ISS can be completed by the end of the decade consistent with the Vision for Space Exploration and our international commitments.